TQ-600 TENTEL® TORQUE GAUGE INSTRUCTION MANUAL

The TQ-600 torque gauge is one of the latest VCR mechanical testing instruments to be manufactured by Tentel. Although torque gauges in various forms have been available for many years, we have endeavored to produce a torque gauge "system" in conjunction with these instructions that will greatly simplify the various torque measurements on VHS format video tape transports. (The TQ-600 can also be utilized for Beta recorders; however, it will be necessary to refer to the instruction manual for each particular transport and play the game of holding micro switches and black tape on sensors, etc.). Since the VHS format represents the vast majority of consumer and duplication machines in the U.S., it was decided to specialize on these VCRs.

A brief review of the various mechanical tests produced with the current Tentel® products would be beneficial for all service technicians who may not be familiar with their features and benefits.

I. TENTELOMETER® Tape Tension Gauges:

An in-line, dynamic tape tension gauge that reads tension simply by sliding the measuring probes over the magnetic tape. Tape tension is of critical importance, out in the tape path, prior to entering the scanning video head drum. The TENTELOMETER® allows tension measurement out in the tape path as close as practical to this critical point. Extreme caution should be exercised when attempting to use one of the manufacturers' tension cassettes to measure holdback tension. The tension cassette does not actually measure tension, but does measure the torque exerted by the holdback reel. The gauge will produce vastly different readings depending upon what brand of machine they are inserted in. A Hitachi tension cassette inserted into a Panasonic VHS recorder will produce no meaningful data, ditto JVC and some RCA VCRs. The reason for this is simple: these cassettes can *only* measure the holdback torque exerted by the supply reel and since different brands of VCRs, and even different models within the same brand have different tape paths and guiding systems, the reel torque requirements must change to ensure that the tape tension (for interchange), at the entrance to the video drum, is consistant from model to model, and brand to brand.

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The TENTELOMETER eliminates this problem by measuring tape tension out in the tape path near the critical video drum location. Additional TENTELOMETER benefits are that the calibration can easily be checked and "tweaked-up" in the field, and the gauge will not be damaged by a VCR that is causing tape destrucion. Many TENTELOMETER customers have learned these facts the expensive, first hand way.

II. TSH Spindle Height and Elevator Gauge:

A gauge with precision indicators on both the supply and take-up spindle positions. The base plate of the gauge is configured to cassette specifications and is constructed of stabilized cast aluminum tool and die plate. The gauge goes into a VCR just like a cassette; the indicators are visible thru the tape remaining window in the top of the elevator assembly. The gauge can be used in front loading VCRs too, with the indicators visible by removing the top cover of the machine. Since the gauge can be used without removal of the elevator assembly, it not only saves time but it can locate problems with the elevator assembly, not detected by any other method. Bent, warped, or misaligned elevators can cause the cassette to be held away from the 4 cassette locating posts thus causing an "effective" spindle height problem. The actual spindle height can easily be read directly on the TSH gauge indicators. The desired specification can be read on the precalibrated indicators; deviations from ideal location are provided in both tenths of a millimeter and thousandths of an inch, so it's not a trial and error process to make the desired corrections. The importance of correct "spindle height" is stressed in many of the Japanese service manuals as being extremely critical since all the guide heights out in the tape path are performed only after the spindle height has been set-up correctly. Misalignment in either spindle height or elevator position causes tape edge damage, binding and rubbing cassette problems.

III. HPG; Head Protrusion and Eccentricity Gauge:

The universal head protrusion gauge (HPG) allows a fast, accurate, safe measurement of the video and Hi-Fi audio heads to be made on virtually any VCR. The gauge reads directly in microns (millionths of a meter), and ten thousandths of an inch (.0001). This gauge allows accurate measurement of the protrusion (tip projection) of the small fragile ferrite head tips on the video drum. This provides invaluable data to allow service technicians to accurately predict remaining head life, or to take the guessing out of video head wear and replacement. Obsolete or low end (low cost) VCRs may not be economically repairable when the video heads show extreme wear; indicating many hours of use on other components as well. The HPG has micrometer adjustments for both "X" and "Y" direction to allow fast accurate positioning of the special patented probe against the video drum. The universal mounting clamp adapts to virtually any metal chassis transport and an accessory mounting stand is available to allow use with plastic chassis and portable VCRs. The same gauge and mounting position can be used to facilitate adjustment or to check drum eccentricity, which is of critical importance on the newer VHS Hi-Fi and Beta VCRs.

IV. TQ-600 Torque Gauge:

The Tentel TQ-600 torque gauge is not a revolutionary new product like the other 3 Tentel gauges, but does represent a cost effective answer to measuring the various torques critical to the proper functioning of a VCR. Torque and tension are different, but are related by the following formula:

$$\text{Torque} = \text{Tension} \times \text{radius}$$

Relating this formula to a VCR; this means that the tape tension (in grams) as measured with a TENTELOMETER when multiplied by the radius of the tape reel during measurement (in centimeters) would provide a torque when the two values are multiplied together and the units would be gram centimeters (gm-cm). The torque gauge is calibrated directly in gm-cm, eliminating any need for mathematics. The TQ-600 is calibrated in 25 gm-cm increments from 0 to 600 gm-cm. The gauge can read either clockwise (+), or counterclockwise (–) torque quite accurately, and the test for correct calibration is that the pointer returns to the zero mark when no torque is applied to the handle; otherwise the torque arm must rotate freely in the torque body to assure that no binding is occuring which would impare the accuracy of the gauge. The integral spindle adapter allows use of the gauge on both VHS and Beta VCRs. For use on Beta format recorders, please refer to the individual service manuals for "proper" torque specifications and measurement procedures; however, the TQ-600 will provide accurate readings in gm-cm that can be compared directly with values provided in the manuals. A similar approach could be used for VHS recorders, but since there are so many millions of VHS VCRs in daily use, we are providing an additional "system" and instructions for use with VHS recorders. Since there are literally hundreds of different models and manufacturers of VCRs, questions or problems arising from Tentel's simple "TEACH" method should be referred to the actual service manual for the specific VCR in question. Be careful however, as we found several discrepancies in some manufacturer's manuals, where they interchanged or misused the units and definition of torque versus tension. Hopefully the problems occurred in the translation from Japanese to English, or they may have been written by technical writers not adequately familiar with the difference between the two terms. There are a number of torques in a VCR and they come into operation during different operating modes and even "between" different operating modes. Research into the various manufacturer's instruction manuals shows errors, omissions, and fortunately similarities among the various torque values and methods of measurement. Since much of each instruction was devoted to the proper method of "fooling" the VCR into acting as if a cassette was inserted, we developed a modified cassette housing that inserts into a VHS recorder, but has access holes in the top to allow easy insertion of the torque gauge onto either the supply or take-up spindle for torque measurements. The cassette is referred to as the **T**entel **E**asy **A**ccess **C**assette **H**ousing (TEACH), model TQC-0. To utilize this system:

A.) Merely remove the top cover of the elevator assembly (top loader) or the machine cover for a front loader.

B.) With power on, insert the TQC-0 into the VCR.

C.) The spindles should now be easily accessable thru the holes provided in the top of the TQC-0. If there is a solid obstruction over these holes that would prevent insertion of the TQ-600, it will be necessary to either remove the obstruction, the entire elevator assembly (and thus the obstruction) or revert to the manufacturer's instruction manual for that particular VCR and proceed as they specify.

D.) Looking from the front of the machine, the spindle on the left is the supply spindle, and the spindle on the right is the take-up.

Perform the following tests:

Stop mode (Power On):

1.) Place the torque gauge over the supply spindle, smoothly rotate in a CCW (-) direction, the torque should read *50 to 150 gm-cm.* Now rotate the torque gauge CW (+) the torque should be more than *400 gm-cm.*

2.) Leave the torque gauge on the supply spindle. Grasp the handle of the TQ-600 and again push the "play" mode. While the mechanism is threading-out, rotate the gauge CCW (-), you should obtain a reading between *50 and 220 gm-cm.* You will only have a few seconds for this measurement so you may want to repeat it more than once. After the VCR locks-up in the play mode, stop rotating the torque gauge, and hold the handle firmly. Either press "stop" or allow the VCR to "stop" automatically if it is equipped with the supply spindle motion sensor; read the torque on the supply reel while the VCR is going from "play" to "stop". The gauge should read (+) *90 to 190 gm-cm* during these few seconds between "play" and "stop".

3.) The machine should now be in the stop mode with the TQ-600 on the supply spindle: good. Press the "Rewind" (REW) button, holding the handle of the torque gauge. The reading should be *over 350 gm-cm.* Press "stop". With the torque gauge still on the supply spindle, press "Fast Forward" (FF), rotate the TQ-600 CW (+); there should be almost no torque in this mode; approximately ½ of a division on the gauge, *5 to 20 gm-cm.* Again press "stop".

4.) Place the torque gauge over the Take-up (T/U) spindle, smoothly rotate the gauge CW (+), the torque should read *50 to 150 gm-cm.* Now rotate the torque gauge CCW (-), the torque should again be more than 400 gm-cm.

5.) Hang in there we're almost done, you're doing great — each time it's going to get easier.

6.) Leave the torque gauge on the T/U spindle and press "play" mode. The machine should thread-up just as if a tape were inserted. If the machine threads-up, but shuts off in a few seconds, there is a safety device in many machines that operates a shut off if the supply spindle does not rotate during play. On these machines, merely grasp the supply spindle, and rotate with your left hand as you hold the handle of the TQ-600 with your right hand. The T/U torque should measure between *80 and 200 gm-cm.* Low take-up torque is one of the leading causes of tape destruction, is usually caused by a worn rubber idler, and is quite easy to fix with the proper replacement part. Now put the recorder in the "stop" mode and let the mechanism return to its rest position.

7.) With the TQ-600 still on the take-up (T/U) spindle, press the "FF" button, holding the handle of the torque gauge. The reading should again be over *350 gm-cm.* Press "stop". With the torque gauge still on the T/U spindle, press "REW", rotating the TQ-600 CCW (-); there should be almost no torque in this mode; approximately ½ of a division on the gauge. *5 to 20 gm-cm.* Press "stop".

Following is a summary chart suitable for duplication:

	TQ-600 Position	**Machine Mode**	**Rotation of TQ-600**
1)	Supply	Stop	CCW(-)
2)	Supply	Stop	CW(+)
3)	Supply	Stop to Play	CCW(-)
4)	Supply	Play to Stop	Hold
5)	Supply	REW	Hold
6)	Supply	FF	CW(+)
7)	T/U	Stop	CW(+)
8)	T/U	Stop	CCW(-)
9)	T/U	Play	Hold
10)	T/U	FF	Hold
11)	T/U	REW	CCW(-)

Allowable Range (gm-cm)	Reading	Notes:
50 to 150		Step 1
over 400		Step 1
50 to 220		Step 2-test must be performed during thread out
90 to 190		Step 2-test must be performed as mechanism returns
over 350		Step 3
5 to 20		Step 3
50 to 150		Step 4
over 400		Step 4
80 to 200		Step 6-auto shut off may engage
over 350		Step 7
5 to 20		

You have just made a complete check of all of the torques in the VCR — now use the TENTELOMETER to check the 30+5 gm holdback tension at the inlet impedance roller and the torque/tension job will be complete. Often the torques can be brought into spec by cleaning the spindles and rubber drive pulleys with alcohol or a similar solvent, however, these "repairs" are usually short lived compared with replacement of the worn or oxidized part. On some brands where replacement parts are difficult to obtain, these make-shift fixes are sometimes required to keep the customer happy. You may want to explain that the solution is only temporary, and that given sufficient time to procure the proper part will yield a better repair.

Good luck! — We trust you'll find this useful, and we're working on even better and more useful ways to make your task easier and more productive.

These values have been compiled and tabulated by Tentel Corp. as a helpful aid to customers; due to the number of different VHS machines currently available and increasing "daily", Tentel cannot assume liability for guaranteeing that the values are correct for all machines. When a serious discrepancy occurs, it would be advised to check the procedure and specification recommended by the factory service manual.

For questions or comments, contact: TENTEL Corp., 1506 Dell Avenue, Campbell, CA 95008 (408) 379-1881.

LIMITED WARRANTY

With proper care, handling and storage, your TQ-600 Torgue gauge should provide years of trouble free, accurate torque readings. The TQ-600 Torque gauge is guaranteed to be free of defects in materials and workmanship for a period of one year after delivery to the initial purchaser.

NOTE: The warranty does not cover damage caused by normal wear, accident, abuse, alteration, disassembly or failure to follow instructions. Tentel assumes no responsibility or liability beyond the purchase price of the unit.

The Torque gauge Instuction Manual is intended as a helpful guide only and Tental assumes no liability from its misuse or misapplication.

TENTEL

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